

Summary

We present the Single Cell Printer [1, 2], which features

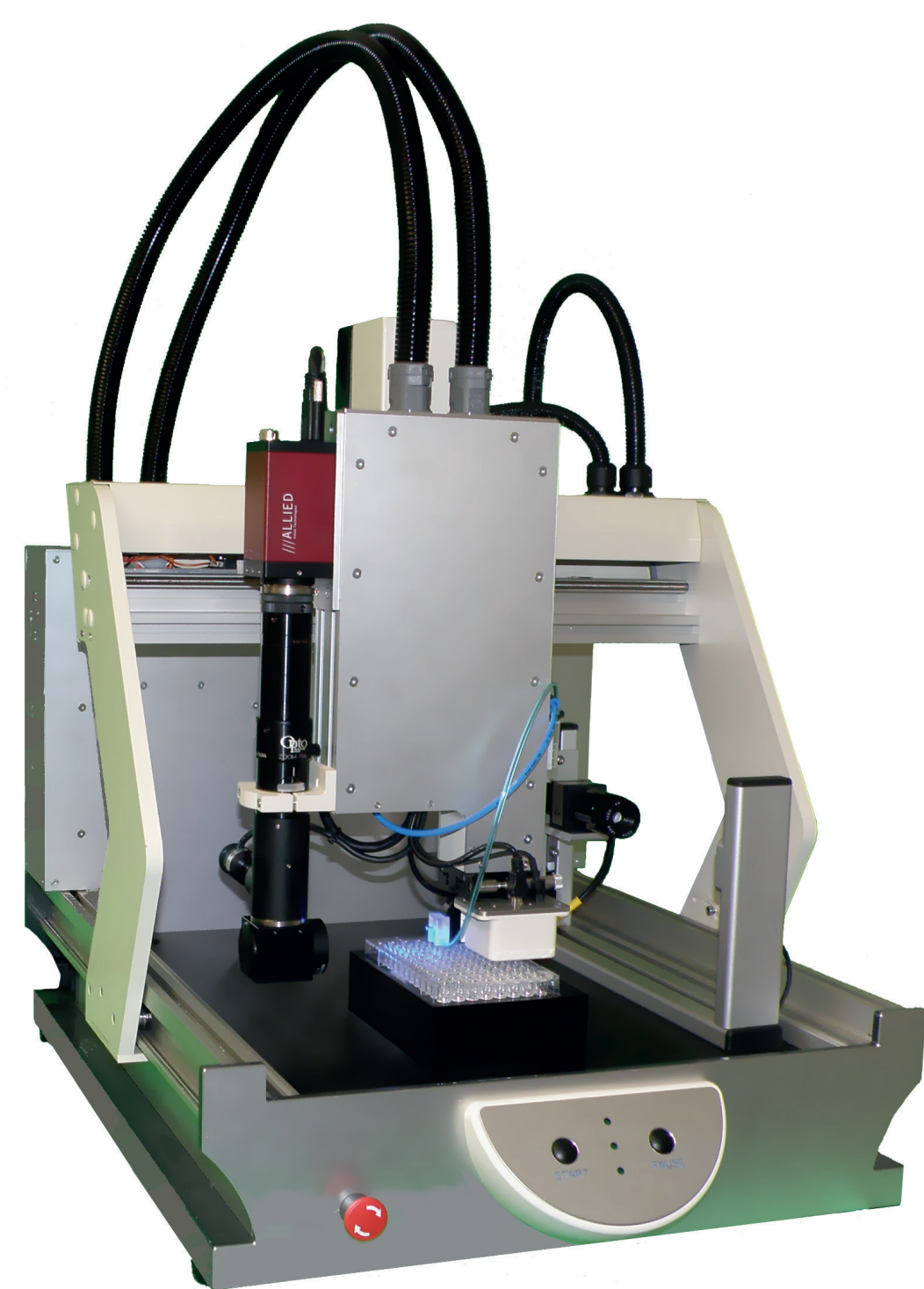
- Optical cell detection
- InkJet-like printing of single cells

and its application in the field of

- Clonal cell line production
- Single cell genomics

Single Cell Printer

The Single Cell Printer (Fig. 1 & 2) consists of a three-axis robot, optics and a transparent dispenser chip. When a single cell is optically detected in the nozzle, it can be dispensed on demand encapsulated in a free-flying droplet (150 pl). Cell detection can be performed automatically by a detection algorithm.



- single cell manipulation
- drop-on-demand printing
- label-free cell detection
- 1.5 µl dead volume
- three-axis robot

Figure 1: Single Cell Printer. Non-contact printing for separation and positioning of single cells.

Clonal cell line production

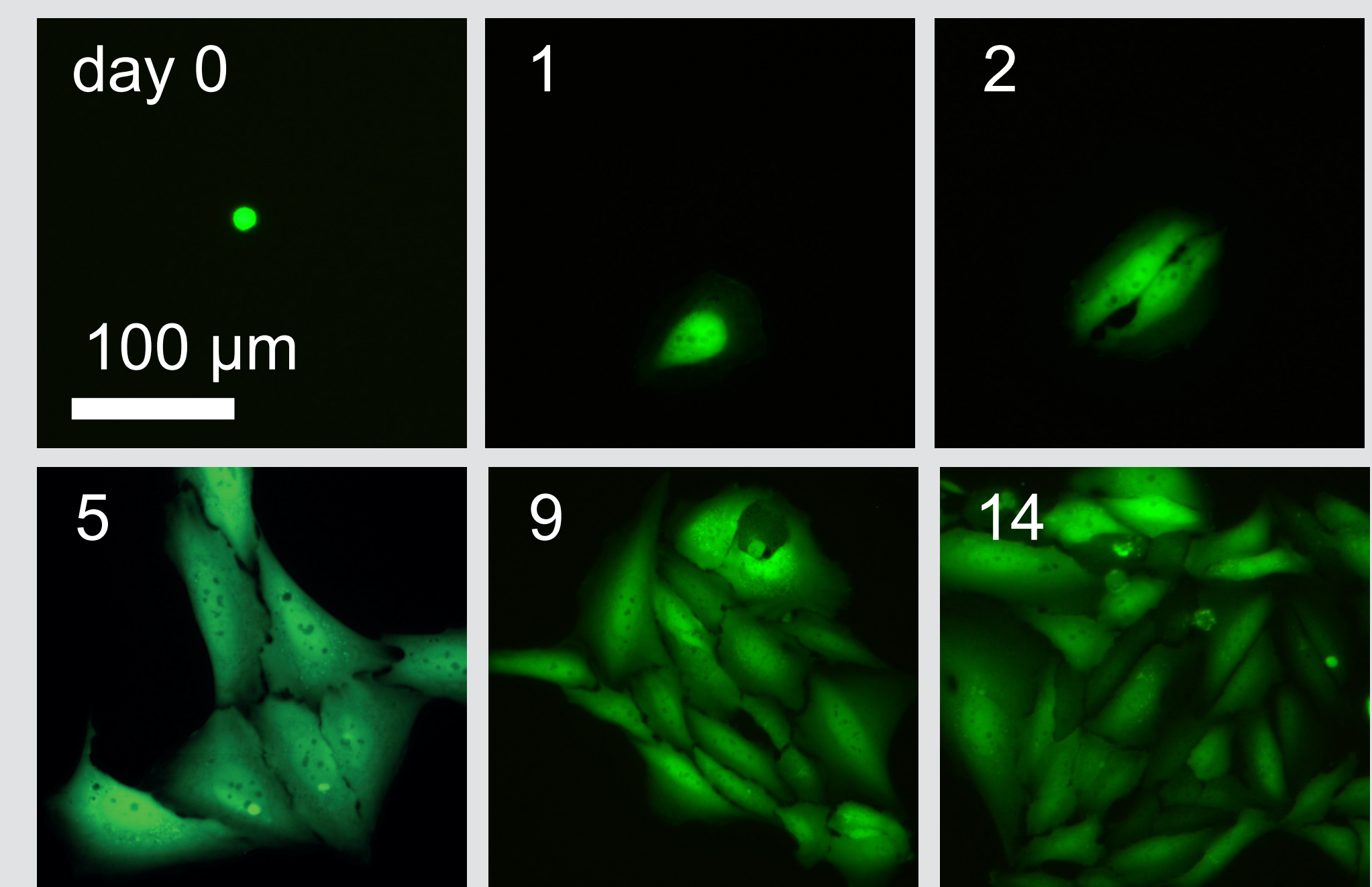


Figure 3: Single bone marrow cancer cell printed into a well and cultured for 14 days.

Fig. 3 shows a single U2OS bone marrow cancer cell printed into a micro well. It has been cultured over 14 days and proliferation has been observed.

Single Cell PCR

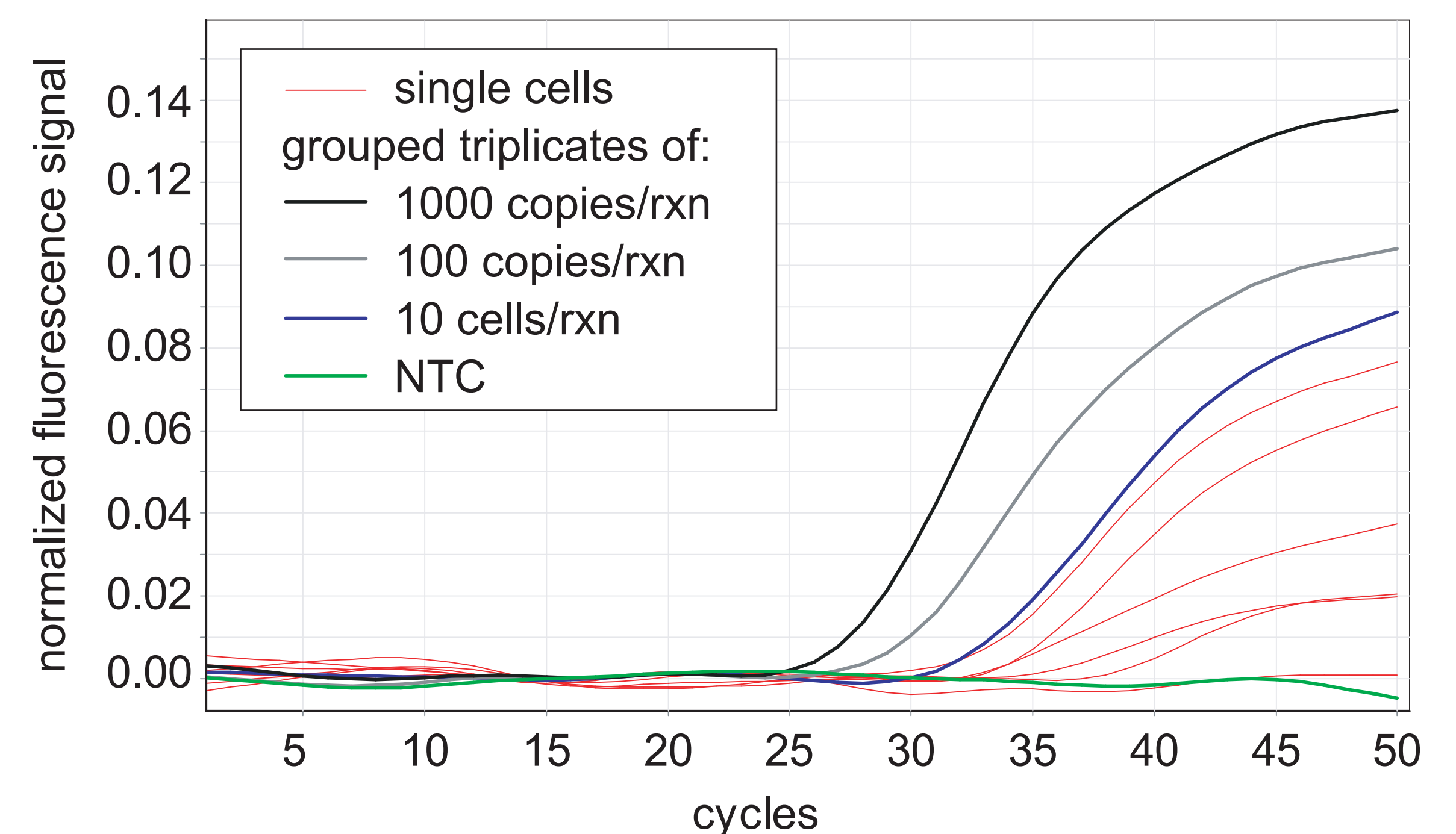


Figure 4: Result of a single cell PCR experiment. Positive signals were measured in 5 out of 6 single cells samples [3].

Conclusion

Non-contact printing of single cells is a versatile method to position cells individually on any uncovered substrate, which allows for various downstream analysis methods.

Acknowledgements

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References

- [1] "Inkjet-like printing of single-cells", A. Yusof et al., Lab on a Chip, 11, 2447 (2011)
- [2] "Single-Cell Printer Automated, On Demand, and Label Free." A. Gross et al., JALA 18.6 (2013)
- [3] "Non-Contact Single Cell Printing For Single Cell Real-time PCR", J. Schoendube et al., EMBL Microfluidics 2012

Single Cell Printing Principle

A machine vision system detects single cells in proximity of the nozzle before droplet ejection. Droplets, predicted to contain no cell or more than one cell, are deflected by a pneumatic shutter system. Only droplets with exactly one single cell are printed onto the substrate.

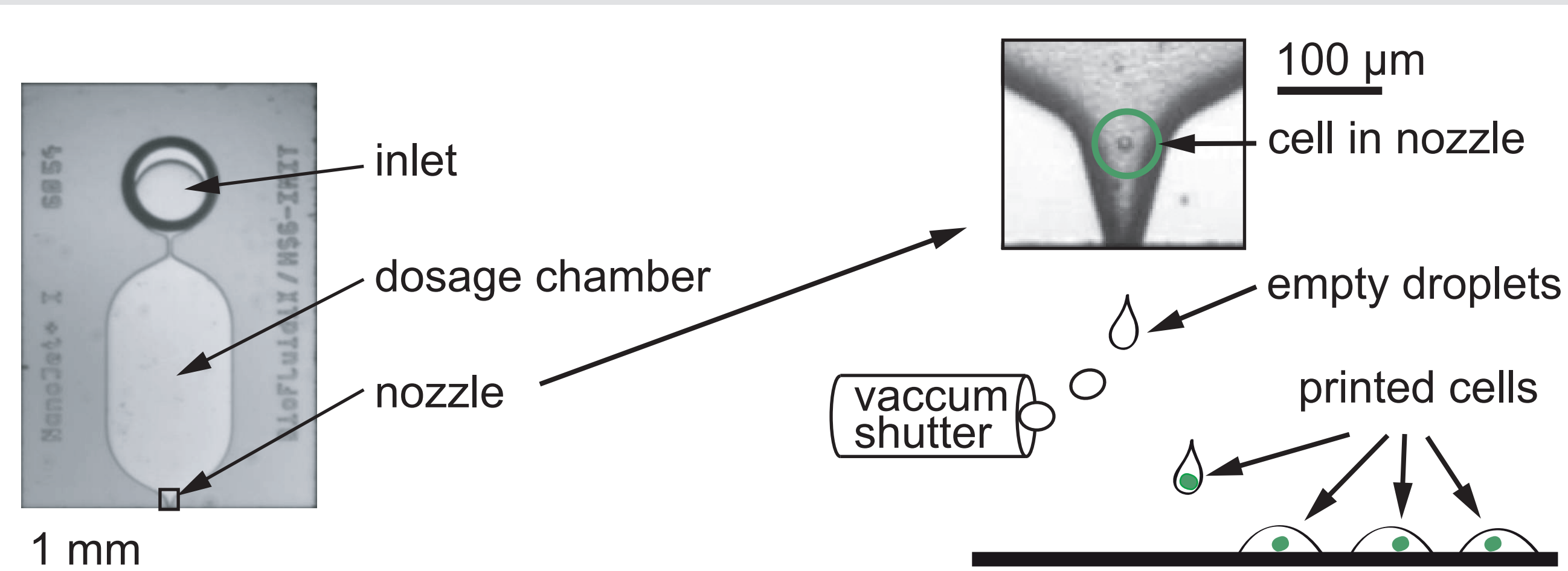


Figure 2: NanoJet cell dispenser chip fabricated from silicon and glass and single cell printing.